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Notes on cultures of Gymnosporangium made in 1887 and 1888.

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In a paper "On certain cultures of Gymnosporangium, with Notes on their Rœsteliæ," published in the proceedings of the American Academy of Arts and Sciences (vol. xxii, p. 259), I gave the results of experiments undertaken in the spring of 1886, at the suggestion of Prof. Farlow, with a view to determine, if possible, the connection existing between the various species of Gymnosporangium and Rœstelia found in the vicinity of Boston; and since the publication of the paper referred to, similar cultures have been continued yearly, the results of which are given in the present article. In order, however, to make myself intelligible, it may be expedient to summarize my previous results, the more so since my later cultures necessitate some modification of the views then expressed concerning one at least of the Rœsteliæ obtained.

Having in the cultures of 1886 succeeded in obtaining æcidia from five of the seven species of Gymnosporangium common in New England, it became necessary to determine with some accuracy to which of the numerous forms of Rœstelia these æcidia severally belonged; and to this end a large number of specimens were examined, including numerous examples from European exsiccati, which the kindness of Prof. Farlow placed at my disposal. As a result of this examination, it became evident that the opinions generally accepted in this country concerning the identities existing between the American and European forms were erroneous in several important particulars.

RŒSTELIA PENICILLATA, for example, a species incorrectly referred to R. lacerata, by certain authors, but very properly retained as distinct by Winter (Pilze, p. 266), was found, after an examination of several authentic European specimens, to be a well-marked form quite different from any known American species. R. penicillata, therefore, must be definitely excluded from the list of American forms unless it has been wholly overlooked; a supposition which seems

quite improbable. Turning to the American forms previously included under the name "penicillata" it was found that they included two well-marked species, namely, R. pyrata and R. lacerata.

RŒSTELIA PYRATA, the Æcidium pyratum of Schweinitz, which was obtained from sowings of G. macropus upon Pyrus Malus, was found to be a peculiarly American form, readily separable from any known European species and not to be confounded with any other American species: from all of which it is readily distinguished by its habit alone, as well as by its microscopic characters. It is distributed in Ellis' N. A. Fungi No. 1086 a, b, and d (*not* c), under the name "penicillata," and also from America in Thuemen's Myc. Un. No. 732 under the name "lacerata." It is very common on Pyrus malus and often destructive, but grows most luxuriantly on P. coronaria; and may be readily distinguished from the only other Rœstelia common upon Pyrus malus, by its *revolute* peridial lacerations. I make this statement in detail from the fact that I have subsequently been quoted as considering R. pyrata a form of R. penicillata, whereas my expressed opinion was exactly the contrary of this statement: and also for the reason that I notice the name "penicillata" still retained by certain American writers when referring to R. pyrata, which is a manifest error.

The second form above referred to, which has, in this country, been wrongly considered a form of R. penicillata, is beyond question the true

RŒSTELIA LACERATA.—This was obtained from sowings of G. clavariæforme on Cratægus. In its general habit it bears a superficial resemblance to R. pyrata, but the peridial lacerations are only slightly divergent, not revolute; while it is also readily separable microscopically. In its most typical form it attacks the fruit and tender shoots of Cratægus, and more especially of Amelanchier; but it also occurs upon the leaves of both these plants, and has recently been found by Prof. Farlow on the fruit of Pyrus arbutifolia, a hitherto unrecorded host. The species is distributed in Ellis' N. A. F. No. 1086 c, in my copy, (*not* a, b or d), under the name "penicillata," and also under the names "*carpophila* Bagnis" (Myc. Un. 1326) and "lacerata" in various European exsiccati. "Rœstelia lacerata," however, as it is commonly understood in this country, is quite another thing. In my previous paper I spoke of the forms referred to R. lacerata for the sake of convenience as lacerata *x*, *y* and *z*: "lacerata *x*" being used

for the true R. lacerata as above distinguished: "lacerata *y*" for the form common on Cratægus, usually known in this country as the typical R. lacerata, and distributed in Ellis' N. A. F. No. 1085 under this name, the specimens labelled "a" on Cratægus coccinea being the most typical: while "lacerata *z*" was used to designate a small form apparently not distributed, but very common (in New England, at least) upon leaves of Pyrus Malus, especially on wild stock. These two forms ("lacerata *y*" and "*z*") I shall have occasion to refer to presently in connection with G. globosum. It is, therefore, sufficient to say that I then suggested their identity with

RŒSTELIA CORNUTA.—To this species I was constrained, I think erroneously, to refer the æcidium which followed the infection of Amelanchier with what I then considered the American form of G. conicum, namely, the common "birds'-nest" Gymnosporangium figured in Farlow's "Gymnosporangia of the U. S.," plate II, fig. 22, under the name G. clavipes, and distributed also as clavipes in Ellis' N. A. F. No. 1084 b (*not* a). I say constrained, since the Rœstelia was referable to no other described species, and it seemed that the differences between the culture and our supposed forms of R. cornuta might have been accidental.

RŒSTELIA BOTRYAPITES, a form not to be confounded with any other American species followed sowings of G. biseptatum on Amelanchier.

RŒSTELIA AURANTIACA which followed sowings of the true G. clavipes on Amelanchier stems is also too well marked to need further comment. It may be mentioned here, however, that although Cratægus, Amelanchier, Pyrus Malus and Cydonia are the only recorded hosts of this species, it has been observed by Prof. Farlow on the fruit of Pyrus arbutifolia in Massachusetts, and Mr. Miyabe has kindly sent me a specimen collected by him on the same host at Grand Menan Island.

The experiments with G. Ellisii were not satisfactory, while G. globosum produced nothing beyond its usual luxuriant and brightly colored spermogonia on Cratægus: spermogonia also appearing on Sorbus and Amelanchier: but in no case producing æcidia, the leaves having withered and fallen off about two months after their infection.

The above contains in general the results of my first cultures. Turning now to those subsequently made the results were as follows. It should be stated at the outset that, like the first set of cultures, those subsequently made were conducted

under conditions as rigid as they could practically be made, a circumstance upon which, I think, too great stress cannot be laid in connection with any experimental work of this nature. In all cases the Gymnosporangia were gathered before they had had an opportunity of becoming mixed; in fact before they were fully mature, and the hosts for infection were in all cases potted plants, started early in the house or greenhouse, and infected in different rooms or buildings, being subsequently kept separate till all danger of accidental mixture was past. It is hardly necessary to point out the superiority of this method over cultures made out of doors, in which the possibility of error cannot be eliminated; but by far the most crucial test in such cases is gained by forcing the fungus as well as its host so as to make the infection a month or more before it would naturally occur out of doors, as was done, for example, in the second culture of G. globosum given below. In this way the sources of error are reduced to zero if, as in this case, only one species of Gymnosporangium is used. As in my previous cultures, I have found it more convenient to place the spore masses directly upon the sprinkled leaves, as soon as the sporidia begin to form, and to keep the plants covered with bell glasses or wet paper for one or two days, carefully removing the jelly as soon as these were taken off.

CULTURES OF 1887.

G. MACROPUS.

March 1. Sporidia sown on

2 *Pyrus Malus*,

both host and fungus having been forced in a greenhouse where the subsequent development was watched.

March 10. Spermogonia appeared abundantly on both plants, from which one recovered while the other

May 1, produced æcidia of *Roestelia pyrata*.

G. CLAVARIÆFORME.

April 24, sporidia sown on

2 *Amelanchier Canadensis*.

April 27, sporidia sown on

1 *Amelanchier Canadensis*.

1 *Crataegus coccinea*.

May 1. Spermogonia appeared on the two first Amelanchiers, which were much distorted.

May 5. Spermogonia on the second Amelanchier. No result with the *Crataegus*.

May 6. The two first Amelanchiers much swollen and distorted, æcidia already beginning to appear.

May 12. Æcidia of *Roestelia lacerata* ("*lacerata x*") developed luxuriantly on all the Amelanchiers. No result with *Cratægus*.

"G. CONICUM."

April 28. Sporidia sown on
2 *Cratægus coccinea*.

May 4. Sporidia sown on
2 *Pyrus Malus*.
2 *Cratægus coccinea*.
1 *Amelanchier Canadensis*.
2 *Sorbus*.

May 8. Leaves of one *P. Malus* much discolored, but no spermogonia developed. Sporidia sown on
1 *Amelanchier Canadensis*.

May 12. Leaves and stems of both Amelanchiers much distorted.

May 14. Spermogonia on both Amelanchiers. No results with the other plants.

May 24. Æcidia began to show on the Amelanchiers, which developed into a *Roestelia* identical with that obtained from the same *Gymnosporangium* in 1886.

G. GLOBOSUM.

During the second week in May (the exact date not recorded) sporidia were sown on large potted plants as follows:

2 *Cydonia vulgaris*.
2 *Pyrus Americana*.
3 *Cratægus coccinea*.
2 (small) *Pyrus Malus*.

Spermogonia appeared abundantly on *all* these hosts in ten days, especially on the *Cratægus*. The plants were watched in the house until June 7, when they were set out in the yard of the house in Boston where the culture was made, and left during the summer. On examination early in September "*lacerata y*" was found developed abundantly on the *Cratægus*, and "*lacerata z*" on two leaves of apples, the leaves having fallen from both the *Cydonia* and *Sorbus*.

CULTURES OF 1888.

G. GLOBOSUM.

March 17. Sporidia sown on
1 *Pyrus Malus*,
3 *Cratægus*,

all having been forced in the greenhouse at the botanic garden in Cambridge.

March 28. Spermogonia appeared abundantly on all the infected plants. These were then watched carefully for three months, at the expiration of which,

June 19. Æcidia began to appear on the leaves of the *Crataegus*, while the apple showed swellings beneath the spots of spermogonia. These swellings began slowly to produce æcidia, having, as far as could be judged, the characters of "*lacerata z*," but

July 7. The leaves suddenly turned yellow and fell off, while at this date "*lacerata y*" was abundantly developed on the *Crataegus*.

"G. CONICUM."

Two plants of *Amelanchier* were sown with sporidia of the "birds-nest" *Gymnosporangium* for class illustration on May 12, spermogonia appearing in about a week (the exact date not noted), and during the second week in June a *Roestelia*, similar in all respects to that obtained in the previous years, was well developed upon the stems and leaves.

The cultures of 1887–88, then, agree with the results of the previous year in all respects so far as the æcidia obtained from the corresponding Gymnosporangia is concerned, and supplement them by the addition of the æcidial form of G. globosum, the relation of which to any æcidial form has heretofore been a most perplexing question. The cultures establishing this relationship which were made in 1888 were, it will be noticed, conducted with the greatest care. The fungus and its host were forced in a greenhouse, and the infection made more than six weeks before it would naturally have occurred out of doors, and the plants were constantly examined during the whole period from infection to the production of æcidia. No other species of Gymnosporangium was brought into the greenhouse, and when the season for the natural development of the fungus out of doors had arrived, the possibility of infection from without was past. There is, therefore, no shade of doubt connected with the experiment, the result of which is, moreover, supported by the results obtained in the more careless cultures of the previous year. Although in the present instance the culture on apple was not carried as far as could have been desired, I think it may be safely assumed that both "*lacerata y*" and "*lacerata z*" are æcidia of G. globosum. This conclusion is somewhat of a surprise, since G. globosum has been considered a very near ally of the European G. fuscum, of which it was originally described as a variety. The æcidium of G. fuscum, on the other hand, is stated definitely by Mr. Plowright to be R. cancellata: a conclusion in harmony with the

views of previous experimenters. But "*lacerata y*" and "*z*" have not the slightest resemblance to R. cancellata. On the contrary, as I pointed out in my previous paper, the Rœstelia which I called "*lacerata y*" is closely allied to R. cornuta, which has been referred by Mr. Plowright, also in concurrence with previous opinion, to G. conicum.

Turning for a moment to our birds'-nest Gymnosporangium, the question of identities is still further confused by my cultures of this species, made on three successive years with identical results. The Rœstelia obtained, as I have mentioned above, was referred to R. cornuta, there being no other alternative among described American Rœstelias. It seemed not unlikely that the differences between the culture and R. cornuta might have been accidental; but the subsequent cultures render this supposition very improbable. In all cases we have the same rapidly-developing Rœstelia resembling R. lacerata in its mode of growth. In nature the form has probably been confused with R. lacerata, with which it must occur simultaneously on Amelanchier. It should be noted that upon Sorbus (the natural host of R. cornuta) the most careful sowings of our "birds'-nest" Gymnosporangium have given no result whatever; and also that, although our species is certainly known to occur only on Juniperus Virginiana, the European G. conicum is found only on J. communis. Further careful cultures and observation, together with a more extended examination of European specimens than I have been able to make, will, of course, be necessary to confirm this supposition; but I am decidedly of opinion that our "birds'-nest" species is a distinctly American form as yet unnamed.

Unfortunately, however, we still have to account for what appears to be the typical R. cornuta on Sorbus collected at Eastport by Prof. Farlow, and subsequently at Grand Menan Island by Mr. Miyabe, and in the White Mountains by Prof. Farlow and myself. In addition also to these, we have unaccounted for a not very common form on Amelanchier and one on Pyrus arbutifolia found at Kittery, Maine—both of which do not appear to differ essentially from R. cornuta. Whether all these forms may not be referable to "lacerata *y*," and consequently to G. globosum, I do not feel at present prepared to say; but the only remaining alternative would seem to be that the true G. conicum occurs in this country on its proper host (J. communis), but has hitherto been overlooked.

Returning for a moment to the cultures of G. clavariæforme, it is of interest to note that one of the plants infected in 1887, on which the Rœstelia had developed with great luxuriance, was left out of doors over night during a rain, in order to observe the effect thus produced upon its general habit. Before this exposure the peridia had remained unbroken, as is usually the case with cultures carried on indoors; but a single night in the rain was sufficient to induce the typical "penicillate" habit peculiar to the true R. lacerata. This circumstance removes any doubts in connection with my determination of this species which may have rested on the failure of my previous culture to assume a lacerate habit. It should be mentioned here that in the Bulletin of the Iowa Agricultural College for 1887, Prof. Halsted describes a culture of G. clavariæforme made by him out of doors upon Amelanchier with material sent from the east, which resulted in the production of a Rœstelia which he referred to R. botryapites, thus throwing doubt upon my results both with G. biseptatum and G. clavariæforme. Prof. Farlow has kindly allowed me to state in this connection that the Rœstelia communicated to him by Prof. Halsted as resulting from this culture is certainly *not* R. botryapites. That my first result was correct is sufficiently shown by my subsequent cultures, as well as by the conclusions of European experimenters. It is, moreover, quite improbable that a Gymnosporangium, also well known in Europe, should produce a Rœstelia which occurs only in America.

During the summer of 1887 I had some opportunity of observing the Rœstelias occurring in the mountains of North Carolina, concerning which a note may be of interest. At Cullowhee, in the southwest portion of the state, and elsewhere in the same region, cedars (J. Virginiana) were not indigenous, but had been introduced in small numbers, and were in most cases loaded with "cedar apples" to a degree seldom if ever met with in the North, and in one case, near the town of Sylva, two large trees seemed to have been literally killed by them, while in several other cases their detrimental effect was apparent. The season of their maturity was passed at the time (June), but the species were readily recognized as G. macropus and G. globosum, both attaining a remarkable size. I noticed, however, no conspicuous distortions referable to our "birds'-nest" species. Of Rœstelias I found three forms. One on Cratægus Crusgalli, collected at Sylva, fully developed on June 13, I have been unable

satisfactorily to identify. At Cullowhee two or three small cedars badly infested by G. macropus and G. globosum, served to infect the region within a distance of a mile or more, and during June and July the Cratægus and Pyrus coronaria, common in the vicinity, were covered with spermogonia. On leaving this locality (July 18) the spots on Pyrus were developing a luxuriant growth of Rœstelia pyrata, while those on Cratægus showed no signs of ædicia. This Cratægus form was, however, collected and forwarded to me during the following August by my friend Mr. T. B. Cox, and proved to be "lacerata *γ*"; in other words, the ædicium of G. globosum, as was to be expected. Spermogonia were also seen on Amelanchier at the falls of the Tuckaseegee river, between Cullowhee and Highlands; but no ædicia were procurable. The virulence of R. pyrata on certain varieties of cultivated apples in this region was remarkable. I noticed several instances on the road between Sylva and Asheville, where cedars had been planted near small orchards, some of the trees in which were so infested by R. pyrata that the bright color was striking at even a considerable distance, while side by side with these were individual trees which showed no sign of the fungus.

In the mountains of East Tennessee, in other respects a mycologist's paradise, no signs of any Rœstelias were to be found, although shortly after entering the mountains, I saw abundant spermogonia on Amelanchier from the car window.

SUMMARY OF CONCLUSIONS.

Rœstelia penicillata is not found in this country so far as is known. The American forms thus named hitherto, include two distinct species, namely, R. pyrata, which is the ædicium of Gymnosporangium macropus and R. lacerata, which is the ædicium of G. clavariæforme.

Rœstelia lacerata, as it is generally known in collections, and as it is distributed in Ellis' N. A. F., No. 1085, is incorrectly named and is the ædicium of G. globosum, to which should also be referred the smaller form common on Pyrus malus.

R. botryapites is the ædicium of G. biseptatum.

R. aurantiaca is the ædicium of G. clavipes.

R. cornuta is *not* the ædicium of the "birds'-nest" Gymnosporangium previously referred to G. conicum and distributed as G. clavipes in Ellis' N. A. F., No. 1084 (b). The "birds'-nest" form with its Rœstelia as obtained by cultures is therefore probably unnamed, unless G. conicum is erro-

neously connected with R. cornuta by European experimenters. R. cornuta as it occurs in this country on Sorbus, Amelanchier and P. arbutifolia either represents variations in the æcidia of G. globosum or results from the true G. conicum which has been hitherto overlooked.

NOTE.—Since the above was in press the writer has found the Roestelia of the "bird's nest" Gymnosporangium growing simultaneously with R. lacerata very abundantly on Amelanchier, thus confirming the view above expressed. Further details will be given in a subsequent paper, together with notes on cultures made during the present year.

New Haven, Conn.

Flowers and Insects. II.

CHARLES ROBERTSON.[1]

Viola pubescens Ait. (fig. 1).—Müller regards the yellow violets as nearest the primitive type. This is yellow with dark nectar-lines. The petaline spur is little more than a gibbosity. The nectar-secreting processes of the lower stamens are very short, being much wider than long. The summit of the peduncle and the flower axis are strongly curved so as to throw the spur well backwards, giving the flower a characteristic appearance, and this serves to limit the insect visits much more than the mere length of the spur. The tips of the anthers and the style are closely approximated to the spurred petal and obstruct the entrance, so that insects unaccustomed to the flower are effectually baffled in their attempts to reach the nectar. The lateral petals are bearded.

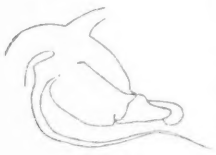


FIGURE 1.

The stigma is nearer the anthers than in V. palmata and V. striata, and self-fertilization in case of insect-absence is more probable.

A proboscis 3 mm. long can secure the nectar, if the bee forces its head in as far as the anthers. Bees receive the pollen mainly on the under side of the head, and work it back into their scopæ, when collecting it. After visiting several flowers, Osmia settles upon a fallen leaf and applies the pollen to her ventral scopa, and then returns to the flowers.

After watching the flowers on six days, between April 16 and 30, I obtained only six visitors; but on April 20, 1889, in two hours watching I added twelve new names.

[1] On the fertilization of the genus see Müller: Fertilization of Flowers, 117-121 and 634.

Hymenoptera—*Apidæ:* (1) Anthophora ursina Cress. ♀, s., once: (2) Synhalonia honesta Cress. ♀, s., once: (3) Ceratina dupla Say ♀, s., once; (4) Osmia albiventris Cress. ♂ ♀ (=O. rustica Cress. ♂), s. and c. p., very ab.: (5) O. atriventris Cress. ♀, s. and c. p., ab.: (6) Nomada bisignata Say ♀, once. *Andrenidæ:* (7) Andrena sp. ♀, s. and c. p., once; (8) Augochlora pura Say ♀, s. and c. p., ab.: (9) Halictus coriaceus Sm. ♀ s.: (10) H. fasciatus Nyl? ♀, s.: (11) H. pilosus Sm. ♀, s. and c. p.; (12) H. connexus Cress. ♀, s.; (13) H. stultus Cress. ♀, s. and c. p.

Diptera—*Bombylidæ:* (14) Bombylius fratellus Wied., s., ab. *Tachinidæ:* (15) Gonia frontosa Say, s., once.

Lepidoptera—*Rhopalocera:* (16) Colias philodice Godt.: (17) Nisoniades juvenalis F.: (18) N. martialis Scud. All sucked in a reversed position, except nos. 1, 14 and 16–18. Paragus tibialis, Melanostoma obscurum and Mesograpta marginata (Syrphidæ) eat stray pollen.

Viola palmata L. var. *cucullata* Gray (fig. 2).—This is our common blue violet. The lateral petals are bearded. The stigma touches the bee in advance of the anthers, and cross-fertilization is the natural result of insect visits. The staminal processes measure 3mm. and the spur about 4mm. The nectar is more deeply concealed than in V. pubescens, and, as a consequence, the list shows more long tongues.

FIGURE 2.

Hymenoptera—*Apidæ:* (1) Apis mellifica L. ♀, once: (2) Bombus separatus Cress. ♀: (3) B. pennsylvanicus De G. ♀; (4) Synhalonia speciosa Cress. ♂: (5) S. honesta Cress. ♀; (6) Ceratina dupla Say ♀, all sucking; (7) Osmia albiventris Cress. ♂ ♀, s. and c. p., ab.; (8) O. atriventris Cress ♀, s. and c. p., ab.; (9) Nomada vincta Say ♀, s. *Andrenidæ:* (10) Andrena sp. ♂ ♀, s. and c. p., ab.: (11) Halictus sp. ♀, s.: (12) H. fasciatus Nyl? ♀, s.

Diptera—*Bombylidæ*: (13) Bombylius fratellus Wied., s.

Lepidoptera—*Rhopalocera:* (14) Pyrameis huntera F.: (15) Colias philodice Godt.: (16) Pieris rapæ L.: (17) Nisoniades juvenalis F.: (18) N. martialis Scud. All sucked head downwards except nos. 6, 11 and 13; nos. 14–18 sometimes upright, sometimes reversing. Observed on nine days, between April 9 and 29.

Viola striata Ait. (fig. 3).—The flower is yellowish white, a few purplish lines on the lower petal forming nectar-guides. The lateral petals are bearded. The stigma is far in advance of the anthers, so that self-pollination is prevented. The spur is considerably longer than in V. palmata. On three days, between April 16 and May 4, I observed only:

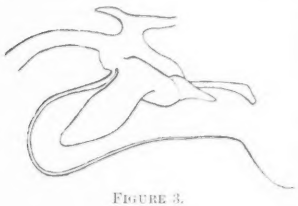


FIGURE 3.

Hymenoptera—*Apidæ:* (1) Synhalonia honesta Cress. ♂, s.; (2) Osmia albiventris Cress. ♀, s. and c. p., ab.; (3) O. atriventris Cress. ♀, s.; (4) O. montana Cress. ♀, s. and c. p. *Andrenidæ:* (5) Andrena sp. ♀, s.; (6) Halictus coriaceus Sm. ♀, s. and c. p.

Diptera—*Bombylidæ:* (7) Bombylius fratellus Wied. s.

Lepidoptera—*Rhopalocera:* (8) Colias philodice Godt.—all reversing except nos. 1, 7 and 8.

Viola pedata L. var. *bicolor* Gray (fig. 4).—The flowers are larger than in any of the preceding species. The two upper petals are of a deep purple, the others blue, the handsome flowers bearing a resemblance to the pansy. The lateral petals are not bearded. The lower petal is deeply grooved and is produced behind into a curved spur from 4 to 8 mm. long. The strong style and the anthers project considerably and oppose the way to the nectar, so that the extent of concealment of the nectar is determined by the distance from the tip of the style to the tip of the spur—a distance of from 12 to 16 mm. The staminal spurs are about 4 mm. long and are very slender. The spur of the lower petal is slender and strongly compressed so as to narrow its cavity. As might be expected, the visitors are the longest-tongued bees, though butterflies often occur. The pollen is shed on the base of the proboscis of the insect.

FIGURE 4.

Hymenoptera—*Apidæ:* (1) Bombus virginicus Oliv. ♀ (14)[2]; (2) B. separatus Cress. ♀ (11–13); (3) B. pennsyl-

[2]Numbers in parenthesis after the name of the bee indicate the length of the proboscis in mm.

vanicus DeG. ♀ (16–17), ab.: (4) Anthophora ursina Cress. ♀ (18), s. & c. p., ab.: (5) Synhalonia speciosa Cress ♂ ♀ (13–15), all sucking in an upright position.

Lepidoptera—*Rhopalocera:* (6) Pyrameis cardui L., once, reversing: (7) Colias philodice Godt., sometimes reversing: (8) Nisoniades icelus Lintn., ab.: (9) N. juvenalis F., both always reversing. *Noctuidæ:* (10) Plusia simplex Guen., once, not reversing. On four days, between April 28 and May 3.

Eristalis latifrons eats stray pollen which falls upon lower petal.

Viola lanceolata L.—At Orlando, Fla., Feb. 17, I found it visited by Hymenoptera—*Andrenidæ:* (1) Halictus capitosus Sm. ♀, s. Lepidoptera—*Rhopalocera:* (2) Phyciodes tharos Dru.: (3) Pamphila sp.

GENERAL NOTES ON THE FOREGOING VIOLETS.—In a paper on the cause of floral irregularity,[3] Viola was mentioned as an exception to the rule that irregular polypetalous flowers have the nectary on the upper side. I think the spur was developed in a way analogous to the galea of Aconitum, *i. e.* on the upper side of the flower, and that it has changed to the lower side as a result of inversion of the flower. The weight of the spur itself may have had something to do with turning the flower upside down. Not only would the flower be expected to have been originally sternotribe from my theory, but it is still properly so, for in most cases it is so formed that bees are required to turn upside down to reach the nectar. Fig. XI of the title page of Sprengel's "Entdeckte Geheimniss" shows a flower of V. odorata with a hive-bee sucking in a reversed position. The spur seems to have become so closely fitted to the bee that after inversion the bee was forced to turn head downwards in order to extract the sweets.

On the part of the flower, the resupinate position seems to be advantageous in enabling it to sift the pollen down upon the insect, instead of exposing it to pollen-eating intruders. Under V. tricolor, Müller says: "The anthers, which together form a cone, shed their pollen into this groove (*i. e.* of the lower petal), either of themselves or when the pistil is shaken by the insertion of the bee's proboscis." It seems to me that the action to which the mechanism is adapted to give

[3] BOT. GAZ., XIII., 207.

rise, and the only action which will insure that the pollen shall be applied to the same side of the proboscis which touches the stigma, is that the pollen discharge shall be effected by the bee itself.

On the part of the visitors, the inversion seems particularly favorable to bees of the genus Osmia, and I am inclined to consider the flowers of V. pubescens, palmata and striata as specially adapted to them, in spite of the presence of other visitors. Now, these bees have their pollen-collecting hairs situated on the ventral surface of the abdomen, so that the position which they must take to suck is the one which enables them to receive the pollen and apply it to their scopæ most conveniently. For this reason, species of Osmia are the most abundant and most useful visitors. Indeed, for the species referred to, I am convinced that Osmia albiventris and atriventris are of more importance than all of the other visitors put together. Müller mentions bees of this genus as visitors of V. odorata, canina and tricolor, var. arvensis.

Delpino (178)[4] has discovered that the beards on the lateral petals are intended for the bee to cling to when it turns head downwards. He rightly regards the bees which reverse as legitimate visitors, and considers the action of Anthophora pilipes on V. tricolor as illegitimate, since it inserts its proboscis without turning. Really, the proper visitors are bees which are small enough to use the beard as a support; so that the humble-bees and butterflies may properly be classed as intruders, even when they reverse. For the proper visitors of the bearded violets we must look to small bees, among which the Osmias are most important.

Remembering that the bearded violets are sternotribe, it is interesting to observe that they become nototribe with respect to all visitors, like Anthophora and Bombylius, which fail to reverse, and this enables us to understand how a properly nototribe violet might be produced. V. pedata is a violet of this sort, being visited mainly by long-tongued bees, which light upon the spurred petal and remain upright. The lateral petals have lost their beards, since they are no longer of use to the bees. The flower still retains the upward curvature of the spur as an ancestral character. If the spur had been developed with reference to visitors acting like most of those now seeking it, I think it would curve down rather

[4] Numbers in parenthesis after an author's name are the numbers of titles in Thompson's Bibliography. See Müller: Fertilization of Flowers, pp. 599-634.

than up. The effect of the upward curvature of the spur is well illustrated in the behavior of Nisoniades, which invariably turn head downwards.

It has often occurred to me that Bombylius could suck the bearded violets more easily than the insects which reverse, and that under certain conditions it might take possession of them, as Anthophora and Bombus have done in the case of V. pedata. In this connection, it is interesting to refer to Müller's observations on V. calcarata. He saw Macroglossa stellatarum visit 194 flowers of this violet in 6¾ minutes. So rapid a visitor might easily take possession of any flower which suits its fancy. V. calcarata appears to have become completely adjusted to a new set of conditions, for its spur, as shown in Müller's figures, turns downward, and not upwards as in V. pedata.

Claytonia Virginica L.—The proterandry of this flower was first recorded by Bessey (87). He concludes that the adaptations are to favor cross-fertilization and to prevent self-fertilization, and my observations confirm his view. On the other hand, Meehan, in a paper on "The 'Sleep of Plants' as an Agent in Self-fertilization" (485), regards it as commonly self-fertilized by closing of the petals. This mode of self-fertilization was discussed by Ch. Fermond[5] in 1859, but C. Virginica is a very poor example of it. Indeed, it is most erroneous to suppose that it is commonly self-fertilized in this way, for it is one of the most marked cases of proterandry in native plants.

On the first day the stamens stand in the center of the flower and the anthers discharge their pollen, but the lobes of the stigma remain closed. The flower is visited very abundantly by insects which suck up the honey and which eat or collect the pollen, so that by the time the flower closes the pollen is commonly all removed. On the second day the stamens are bent over, holding the empty anther against the petals. The stigma lobes are now separated, and the flower is in the second or female stage. If self-fertilization by closing of the flower occurs, it is after the anthers have been exposed to insects for two days and the stigma for one, but many flowers which I marked exposed their stigmas again on the third day, showing that fertilization of any kind had failed on the day before. The flowers are therefore male on the first day and female on the second and sometimes on the third.

[5] See Just's Bot. Jahresbericht, IV, 939.

Moreover, Meehan states that he did not see the flowers visited by insects—an observation easy to make on any flower. The plants grow in large patches and are very attractive to a great variety of insects. The nectar is not deep seated, so that rather short tongues can reach it. On 26 days, between April 8 and May 11, the following visitors were observed:

Hymenoptera—*Apidæ:* (1) Apis mellifica L. ☿, s. and c. p.; (2) Bombus virginicus Oliv. ♀; (3) B. vagans Sm. ♀; (4) B. pennsylvanicus De G. ♀; (5) Synhalonia honesta Cress. ♂; (6) S. speciosa Cress. ♀; (7) Ceratina dupla Say ♂; (8) Osmia lignaria Say ♂ ♀; (9) O. albiventris Cress. ♂ ♀; (10) Nomada bisignata Say ♀; (11) N. luteola St. Farg. ♂ ♀, all only sucking, except no. 1. *Andrenidæ:* (12–20) Andrena spp., s. and c. p., ab.; (21) Agapostemon radiatus Say ♀, s and c. p.; (22) Augochlora pura Say ♀, s.; (23) A. lucidula Sm. ♀, s.; (24) Halictus sp. ♀, s. and c. p.; (25) H. coriaceus Sm. ♀, do.; (26) H. fasciatus Nyl? ♀, do.; (27) H. pilosus Sm. ♀, do.; (28) H. connexus Cress. ♀, do.; (29) Colletes inæqualis Say ♂ ♀, s.

Diptera—*Stratiomyidæ:* (30) Sargus viridis Say. *Bombylidæ:* (31) Bombylius fratellus Wied., s. *Conopidæ:* (32) Myopa vesiculosa Say, s. *Empidæ:* (33–35) Empis spp. s. *Syrphidæ:* (36) Melanostoma obscurum Say; (37) Syrphus arcuatus Fall.; (38) S. ribesii F.; (39) S. americanus Wied.; (40) Allograpta obliqua Say; (41) Mesograpta marginata Say; (42) M. geminata Say; (43) Sphærophoria cylindrica Say; (44) Eristalis dimidiatus Wied.; (45) E. latifrons Lu.; (46) Helophilus similis Macq.; (47) Syritta pipiens L.—all sucking and feeding on pollen. *Tachinidæ:* (48) Gonia frontosa Say, s. *Sarcophagidæ:* (49) sp., s.; (50, 51) Sarcophaga spp., s. *Muscidæ:* (52) Lucilia cæsar L.; (53) L. cornicina Mgn.; (54) L. ruficeps Mgn., all s. *Anthomyidæ:* (55–57) spp., s. *Cordyluridæ:* (58) Scatophaga squalida Mgn., s. *Sepsidæ:* (59) Sepsis sp. *Drosophilidæ:* (60) Drosophila sp.

Lepidoptera—*Rhopalocera:* (61) Phyciodes tharos Dur.; (62) Pyrameis atalanta L.; (63) Lycæna comyntas Godt.; (64) Papilio ajax L.; (65) Pieris protodice Bd.-Lec.; (66) P. rapæ L.; (67) Colias philodice Godt.; (68) Nisoniades icelus Lintn.; (69) N. juvenalis F.—all s.

Coleoptera—*Chrysomelidæ:* (70) Megilla maculata De G. *Curculionidæ:* (71) Centrinus sp.

Carlinville, Ill.

BRIEFER ARTICLES.

Curious case of variation in Calla.—A strange and rather remarkable case of variation in the flower structure of this familiar plant recently came to my notice through the kindness of a local florist, who called my attention to it, and upon my observation of its rarity gave it to me for such use as I chose to make of it.

It presented a well marked example of "double flower" in every essential respect. The flower structure of the Calla is so well known that no special description is necessary. The plant itself was perfectly normal to all appearance, save the flower, including care and environment. The stalk upon which this particular flower was borne was not appreciably larger than ordinary. In short, there was nothing to indicate the possibility of the monstrosity prior to its appearance. Yet there it was, a perfectly "double calla," in a very literal sense; for the "double" feature extended to spadix as well as spathe. The only appreciable difference in the parts was in size. The outer and normal flower was very large and fine; the inner was pure in color and texture, but was less than half the ordinary size. This difference was likewise true as to the spadixes, which varied in about the same way, save that they were partially fused together, while the former were wholly distinct.

Such, in brief, is a general statement of the facts. Monstrosity is not an unusual thing in nature, especially under the influence of domestication; but a glance at the literature of the subject, though limited, seems to indicate that this is a rather rare case. According to Professor Gray, indeed most botanists, flowers are to be considered as the morphological counterparts of leaves modified in such way as to conserve the ends of reproduction. The calla has been considered as a striking example of such modification, the transition being so gradual as to be appreciable by even the ordinary observer, there being no floral envelopes save the single, large, modified leaf, in which the original shape is but little changed.

When variations of these envelopes occur they usually show a disposition to revert to primitive conditions, "retrograde metamorphosis," or to go on to multiply after the forms of foliage, "prolification." There are many examples of these among flowering plants; but neither seems to cover the case under consideration, unless it be that of prolification in disguise. Again quoting Prof. Gray: "In the application of morphological ideas to the elucidation of the flower, nothing should be assumed in regard to it which has not its counterpart and exemplar in the leaves and axis of vegetation." (Structural Botany, p. 174, vol. I—sixth edition.) Does the case under consideration not force us to regard some flower structures as at least partial exceptions to the general laws of variation? Unless it may be regarded as a case of prolification in disguise, which seems open to doubt, then there seems really no alternative except to

consider it an illustration of the theory of "saltation," proposed to cover cases of a similar sort in zoölogy.

Not being a specialist in botany, I submit the case, and have reluctantly suggested the above reflections in the most tentative way. If they may awake an interest on the part of those more capable of opinions, this notice will not have been in vain.—C. W. HARGITT, *Miami University Oxford, Ohio.*

Poisonous plants and the symptoms they produce.—When horses, cattle or sheep here die from unknown causes, which have produced more or less marked cerebral disturbance within a few days or hours before dissolution, accompanied by one or more minor symptoms, they are said to have been "locoed," that is, poisoned by some usually mysterious unknown plant. The general symptoms are here given in the order they usually appear:

The animal wanders alone, has unnaturally bright eyes and slight frothing at the mouth, or even extreme salivation occurs and the creature goes about with a stream of clear saliva trickling from its chin to the ground, or else the lips are dry, a little swollen and the whole mouth very hot. The appetite becomes noticeably impaired; large quantities of offensive gas are belched forth, frequently accompanied by a greenish froth mixed with finely chewed food. The brain now becomes plainly affected—control of limbs partially or wholly lost—sometimes muscles of one side of the neck are contracted in a pitiable manner. In a few days, hours or minutes, as the case may be, after proper limb-control is lost, the staggering animal refuses to eat or drink at all, becomes stupid, reels and falls, seldom rising again. Stupor increases, eyes become dull and staring, perfect torpor comes on. Limbs and neck may become quite rigid and extended, or else in natural position and easily moved by the hand. Abdomen usually swells to enormous size. Victim may lie in this condition a week or death may ensue in a few hours; there is rarely any struggle at that time.

Post mortem examination reveals several interesting features. The intestines with their surrounding fat are already green, although the creature may have only just died. The arteries and smaller vessels in the limbs are gorged with thick, black blood. The lining of the first stomach is worn and ulcerated in patches and in some cases seems to have commenced decomposition; is very soft and can be peeled off the muscular layer with thumb and forefinger in big pieces. Lungs and heart almost bloodless, but the brain, particularly the cerebellum, is purplish, soft and pulpy.

The symptoms, etc., vary considerably, and it seems unlikely that one poison causes them all.

Four common plants are here said to "loco" stock, viz.: Oxytropis Lamberti, Leucocrinum montanum, Fritillaria pudica and Zygadenus elegans. The first is now known to produce no evil effects except when

eaten in large quantities for days together. Proper experiments have not been conducted with the others yet. Leucocrinum montanum is said to be very fatal to sheep after the fruit has developed. It grows close in the grass, and its narrow grass-like leaves are not easily avoided by stock. This plant occurs in various parts of the territory, is very common in Lewis and Clarke county, near Helena, and in the Sand Coulee region of Cascade county. Fritillaria pudica is almost the first plant to flower in spring. Before the grass is green horses and sheep often nip off the leaves. The scaly bulb is somewhat acrid to the taste. Zygadenus elegans does not flower so early but sends up its long "grassy" leaves at the same time. Sheep eat much of this plant, even nipping off the panicles when they appear. The whole plant is acrid, but the deep-set bulb is strongly so.

So many sheep, cattle and horses die yearly in all the western territories, presumably through eating poisonous plants, that western botanists should do all in their power to investigate the matter. Not long ago it was reported that a new disease had broken out among horses ranging on the northern foothills of the Great Belt Mountains. The disease first affects digestion only, and victims rapidly lose flesh and get very weak. Soon the renal regions are involved, and although sufferers seldom die they as seldom appear to fully recover: the back remains so weak that no load can be borne or drawn. One man has thirty fine-looking horses affected in this way. As usual, the cause is attributed to "some weed they get."—F. W. ANDERSON, *Great Falls, Montana.*

New Mosses.—Descriptions and drawings of the following new species and of many new varieties, by F. Renauld and J. Cardot, will be issued shortly in the BOTANICAL GAZETTE:

Dicranella Langloisii.—Louisiana (A. B. Langlois).
Dicranum consobrinum.—Minnesota.
Didymodon Hendersoni.—Oregon (L. F. Henderson).
Grimmia tenerrima.— " "
Coscinodon Renauldi.—Kansas (Henry).
Ulota glabra.—Oregon (L. F. Henderson).
Hendersoni.— " "
Orthotrichum productipes.—Oregon (L. F. Henderson).
Bryum crassum.— " "
Hendersoni.— " "
extenuatum.— " "
Fontinalis Kindbergii.—Vancouver (John Macoun). Oregon (L. F. Henderson).
subbiformis.—Oregon (L. F. Henderson).
Brachythecium Idahense.—Idaho (Leiberg).
Microthamnium aberrans.— " " A very interesting moss, of a tropical genus, with the facies of *M. acrorrhizum* (Hsch.) from Brazil, but distinct from all the known species of the genus in the broad, lax cells of the areolation.

The study of Fucus in inland laboratories.—The Fucaceæ are among the most interesting and instructive of the algæ, especially in regard to their reproduction, but unfortunately being strictly marine, they are not easily accessible, at least in the living state, to inland students.

It may be of interest to some of the readers of the GAZETTE to know that this difficulty is not by any means so great as is generally supposed, and that with a little care they may be shipped in good condition for long distances. Last winter (Feb. 3), I received through the kindness of Mr. F. S. Collins, of Walden, Mass., a lot of Fucus, mostly F. vesiculosus, but including also F. platycarpus and F. furcatus. They were simply gathered wet and wrapped in oiled cloth so as to prevent drying, and arrived in perfect condition.

Not having sea-water on hand, a solution of common salt of approximately the same density as ordinary sea-water (3 per cent.) was tried and found to answer admirably. My object was to study the fertilization, and this succeeded perfectly. If the plants are exposed for a few hours to the air, the ripe sexual organs will be exuded from the conceptacles in masses of considerable size. In F. vesiculosus, which is dioecious, the male and female plants are at once recognizable by the different color of the mucilaginous drops which ooze out from the mouths of the conceptacles: the masses of antheridia being orange yellow, while the oogonia are olive brown.

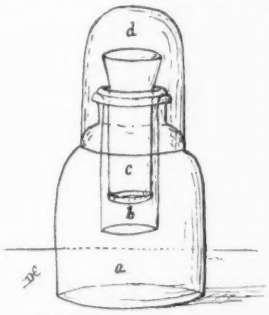
If now a drop from each plant is placed in a drop of the salt water, in a very short time the antheridia will discharge their contents and the water will be fairly alive with the spermatozoids. Shortly after the ova are set free, and almost immediately are surrounded by numerous spermatozoids, which attach themselves to the surface and often are so numerous as to set them in rotation, presenting a most extraordinary sight.

It is best to put the oogonia in the water first and wait until a number of the ova are discharged before putting in the antheridia, as in this way a supply of freshly discharged and active spermatozoids is assured. Care should be taken, too, to support the cover glass with a bit of paper, or some similar object, in order to avoid pressure on the oogonia.

The above experiment was suggested by the account of Fucus in Strasburger's "Botanisches Praktikum,"[1] in which, however, he seemed to think that sea-water was necessary.—DOUGLAS H. CAMPBELL. *Bloomington, Indiana.* ["Sea salt" can be procured at most druggists' and might profitably be substituted for common salt.—EDS.

[1] First German Edition, page 386.

Schultze's dehydrating apparatus.—The accompanying figure shows a very convenient and simple arrangement for gradually dehydrating small objects. It consists of a wide-necked bottle (*a*), into whose neck is fitted a short tube (*b*), and within this a similar but smaller tube (*c*). In order to prevent these tubes from slipping down, the upper part is widened into a small funnel. Each of the tubes has the bottom closed by a piece of parchment paper, which is carefully gummed on. The object to be dehydrated is placed in the tube *c*, which is partly filled with weak alcohol (about 30 per cent.), and this is then placed in the tube *b*, which in turn is put into the neck of the bottle *a*, which has been filled with absolute alcohol. By the diffusion of the fluid through the membranes covering the bottom of the tubes *b* and *c*, the density of the fluids will finally become the same, and the object in *c* will thus gradually be brought into practically absolute alcohol. The cover, *d*, effectually prevents evaporation and at the same time keeps out dust.



DEHYDRATING APPARATUS.

In order to prevent the alcohol in *a* from becoming too much diluted, it is best to use a very small amount of the weak alcohol, and a little calcined copper sulphate placed in the bottom of the bottle will absorb what little water may be present.

Usually two or three hours is sufficient for completely dehydrating most objects, but naturally large ones may take longer. Of course the process may be expedited by covering the bottom of only one of the tubes with the membrane, but it is usually better to have the diffusion take place rather slowly.—DOUGLAS H. CAMPBELL, *Bloomington, Ind.*

CURRENT LITERATURE.

On Nematophyton and Allied Forms.[1]

Prof. Penhallow has presented in this short memoir a most valuable contribution to our knowledge of one of the oldest and most perplexing forms that has claimed the attention of paleobotanists. The original material was collected by Sir W. E. Logan, from the Erian sandstones of Gaspe, about 1852. It was first examined by Dr. (now Sir) William Dawson in 1855, who recognized at once the extreme interest attached to the

[1] PENHALLOW, D. P.—On Nematophyton and Allied Forms, from the Devonian of Gaspé, with introductory notes by Sir William Dawson. Trans. Roy. Soc. Canada. Vol. VI. Sect. IV, 1888, pp. 27–47. Pl. I. II.

discovery. After carefully studying the available material it was published by Dawson under the name of *Prototaxites Logani* with the following diagnosis: "Woody and branching trunks, with concentric rings of growth and medullary rays; cells of pleurenchyma not in regular lines, cylindrical, thick-walled, with a double series of spiral fibers; disks or bordered pores few, circular and indistinct. The specimens are usually silicified, with the bark in a coaly state." Although Dawson states in the notes accompanying Prof. Penhallow's paper that he did not intend to imply its coniferous nature, the fact that it was named *Prototaxites*, and compared with the Aporoxylon of Unger and with the wood of various conifers, was taken to imply its taxine nature, and it was for a long time regarded as one of the oldest ancestors of our modern conifers.

Carruthers was the next to take up the subject. He obtained similar material from the Silurian of Wales, and concluded from its examination that it was the trunk or stem of a gigantic sea-weed. He therefore named it Nematophycus.

It was with a view of settling, if possible, the question of its affinities, that the examination of Prof. Penhallow was undertaken, with the aid of a more extensive and perfect series of specimens. His results, which may be taken as final, fully confirm those of Carruthers. He says "that it is an alga admits of no doubt; and so far as the structure alone will permit a final decision, its affinity with the Laminariaceæ as first pointed out by Mr. Carruthers, who therefore assigned it to the genus Nematophycus, appears to be highly probable."

Dawson has accepted their conclusions, and in his recently published "Geological History of Plants" has modified the name to Nematophyton. The original species becomes N. Logani, and Prof. Penhallow has described a new species, N. laxum, from the lower Erian of Gaspe, which with the Wales species, N. Hicksii, makes up the present known forms.

Prof. Penhallow also describes some very peculiar laminated fossils associated with Nematophyton Logani. They have the appearance of being matted and crumpled masses apparently of fronds, and although the structure is very badly preserved, are fairly comparable to the fronds of the Laminarieæ. They may possibly have been the fronds of Nematophyton, but this is merely conjecture, as they were not found in actual contact.—F. H. K.

Die fossilen Pflanzenreste.[2]

Paleobotany has passed beyond the stage in which the entire body of its workers are devoting their energy to mere description of species, and has entered upon broader, philosophical grounds. That this is true, is shown by the publications of Williamson, Ettingshausen, Renault, Solms-Laubach, and now by the admirable résumé by Dr. Schenk. It is, of course, true that this broader view is only possible after the accumula-

[2] SCHENK, DR. A.—Die fossilen Pflanzenreste. Sonderdruck aus dem Handbuch der Botanik, Bd. IV. Breslau, Verlag von Edward Trewendt. 1888.

tions of data have been made by isolated, individual workers, but it is none the less true that these scattered facts require to be sifted through a philosophical mind before they can be presented as a connected whole. It is a connected view of this general character that the work before us furnishes.

This volume is taken from the magnificent Handbuch der Botanik that is being prepared under the supervision of Dr. Schenk by a number of noted specialists. It is really intended as an introduction to the study of paleobotany, but it also contains a very considerable amount of discriminative matter. In the short introduction he points out the value of the study of plant remains, not only to geology, but principally in regard to the light it throws upon the evolution of existing vegetation. The characters which can be most relied upon in the identification of fossil plants are next discussed. Only a comparatively few plants are so so preserved as to retain their internal structure in suitable condition for study, and for their characterization recourse must be had to marks that in living plants are usually overlooked or ignored. The most important character is that furnished by nervation. The ferns, for example, in which the fructification is not preserved, are arranged according to certain comparatively few types of nervation, which careful study has shown to be reasonably reliable. So, also, with dicotyledons and monocotyledons. Most of the genera can be as clearly identified by the outline and nervation of the leaves as they could be if the whole plant was accessible. The arrangement of cones, scales and leaves in the conifers furnishes a similar key to their positive determination. But, as Williamson long ago pointed out, the internal structure furnishes the most valuable of all data.

The methods or conditions under which plants become fossilized are next described. Incrustation, petrifaction, and the more or less complete change to coal are the three conditions. Then follows the main portion of the work, viz.: an exposition of our present knowledge concerning the various types of vegetation that have been found fossil, and the light thrown by them upon existing vegetation. Beginning with the fungi, for example, it is shown how the various types first appeared in time, and a brief discussion is given of the more important or critical forms. The algæ are similarly treated, especial stress being laid on many doubtful forms that are now under discussion by botanists and zoologists. From these lower forms, the types of vegetation occurring in a fossil state are passed in systematic review, coming ultimately to the higher forms which occur in the later geologic formations and are found both fossil and living at the present day.—F. H. K.

Minor Notices.

THE AUSTRALIAN FLORA has been carefully studied, and many good descriptive and illustrated works published, one of the latest of which is

a thick octavo on the useful indigenous plants, by J. H. Maiden,[3] curator of the Technological Museum of New South Wales. The plants are treated alphabetically under the following headings: Human foods, forage plants, drugs, gums and kinos, oils, perfumes, dyes, tans, timbers, fibers, and miscellaneous. The book is admirably arranged and contains a large amount of useful information, all authenticated by abundant references to sources of information. There are fifty double-column pages of indexes.

THE FIRST FASCICLE of twenty-five Kansas fungi has been distributed by Kellerman and Swingle, of Manhattan, Kansas. The object is to include species never before issued, or on new hosts, or because otherwise noteworthy. The specimens are ample, of excellent quality, and are neatly put up and labeled. The present fascicle contains four species of Cercospora, three of Puccinia, two each of Ecidium, Gloeosporium, Peronospora and Septoria, and one each of the ten remaining genera, all being parasitic forms. The series promises to be a valuable addition to American exsiccati. Those who are not so fortunate as to be remembered in the distribution can purchase of the authors at $1.25 per fascicle until the edition is exhausted.

NOTES AND NEWS.

MRS. LYDIA S. BENNETT, a well known botanist at Fisk University, Tenn., died March 16.

PROF. PETER, of the University of Göttingen, desires seeds of North American species of Hieracium.

MR. A. A. CROZIER has resigned his position as botanist of the Iowa Agricultural Experiment Station. His address at present is Ann Arbor, Mich.

THE LIBRARY of Leopold von Ranke, recently placed on the shelves of the Syracuse University, although mainly historical, yet contains some scientific serials of special value. The largest of these are the *Abhandlungen* of the Berlin Academy, 1788 to 1886, 81 quarto volumes; the *Sitzungsberichte* and *Monatsberichte* of the Academy of Sciences of Berlin, together making 44 volumes; the *Zeitschrift der Gesellschaft für Erdkunde* of Berlin, 1839 to 1885, in 52 volumes; the *Sitzungsberichte* of the Imperial Academy of Sciences at Vienna, 1848 to 1886, 113 octavo volumes, and the *Denkschriften* of the same Academy, in 35 royal quartos; the *Atti* of the Academy of Sciences at Turin, 1865 to 1886; the *Bulletin* and *Annuaire* of the Royal Academy of Belgium, the two series making 169 volumes; the long series of the *Jaarboek* of the Royal Netherland Institute; the *Verslagen* and *Verhandelingen* of the Royal Academy of Sciences at Amsterdam, and reports and memoirs of the scientific societies of Upsala, Copenhagen, St. Petersburg and Dublin. Altogether a fine reference collection of serials for the scientific workers of the institution and vicinity.

[3] MAIDEN, J. H.—The useful native plants of Australia, including Tasmania. pp. 696 8vo. Sydney and London: 1889.